access.

In the foregoing embodiment, at the execution of the recording operation, various signals for the recording operation are supplied from the printer main body to the external connection terminals of the head substrate, whereby the recording execution means can execute the recording operation when the recording image signal and the recording clock signal are externally entered in the first state of the binary logic signal. Also at the execution of memory access, various signals for the memory access are supplied from the printer main body to the external connection terminals of the head substrate, whereby the memory access means can execute access to the data memory means in a timing corresponding to the memory clock signal, when the access permission signal is externally entered. Thus, by utilizing a signal which corresponds to whether or not to execute the recording operation and does not vary during the recording operation, among the signals utilized for recording, as the access permission signal and thus switching the memory access operation, it is rendered possible to simplify the logic circuit within the recording head and to reduce the number of the external connection terminals thereof.

Also in the configuration where the common terminal wiring means supplies the memory access means

with the binary logic signal entered into the external connection terminal and such memory access means recognizes the binary logic signal of the second state as the access permission signal, there is not required the terminal exclusive for transferring such access permission signal to the memory access means, so that the printing head and the printer apparatus as well as the head substrate can be made smaller and lighter and superior in the production capability.

In the above-described head substrate, the common terminal wiring means serially supplies the memory access means with the input signal at the single external connection terminal, at which the recording image signal is serially entered, as the writing data, thereby realizing input of the recording image signal and the writing data by a single external connection terminal.

In the above-described head substrate, the common terminal wiring means serially supplies an external connection terminal, serially receiving the recording image signal, with the data read from the memory access means, thereby realizing input of the recording image signal and output of the read data by a single external connection terminal.

In the above-described head substrate, the common terminal wiring means supplies the memory access means in parallel with the input signals of plural external

connection terminals receiving parallel input of the recording image signal, thereby realizing execution of high-speed input of the recording image signal and the writing data.

In the above-described head substrate, the common terminal wiring means supplies the plural external connection terminals, receiving parallel input of the recording image signal, in parallel manner with data read from the memory access means, thereby realizing high-speed execution of input of the recording image signal and output of the read data.

In the above-described head substrate, the recording execution means is provided with plural recording elements for outputting the recording image signal outputted in parallel from the latch circuit, corresponding to a recording pulse signal externally inputted to a specified one of the external connection terminals, whereby various signals utilized in the recording operation can be utilized for the memory access by terminating the recording pulse signal for the recording elements at the execution of the memory access.

In the above-described head substrate, the common terminal wiring means supplies the memory access means with the recording clock signal of the shift register as the memory clock signal, thereby allowing to utilize an existing signal as the memory clock signal and to

simplify the circuit configuration of the printer apparatus.

In the above-described head substrate, the data memory means executes both data writing and data readout as the memory access operation, while the memory access means selectively executes either of data writing and data readout according to an externally entered mode switching signal, and the common terminal wiring means supplies the memory access means with the input signal to a specified one of the external connection terminals, whereby the data memory means can execute both data writing and data readout.

In the above-described head substrate, the recording execution means externally receives the driving electric power from a specified external connection terminal, and the common terminal wiring means supplies the memory access means with the driving electric power for the recording execution means, thereby allowing to dispense with the external connection terminal for supplying the memory access means with the driving electric power and to reduce the dimension and weight of the printing head and the printing apparatus.

In the above-described head substrate, the external connection terminals, recording execution means, data memory means, memory access means and common terminal wiring means are composed of films

formed on a base substrate, whereby the printing head can be formed compact and light.

[Second embodiment]

In the foregoing embodiment, there has been explained a configuration in which, among the recording signals supplied in the head, a signal corresponding to whether or not to execute the recording operation and not varying during the recording operation is used as the access signal for the memory provided in the head.

In the above-described configuration in which a signal is used in common for the access to the data and for the recording operation, the data stored in the memory may be altered by a noise or the like in the recording operation, but the present embodiment is featured by a fact that the data in the memory of the head are not overwritten even in case a signal is used in common for the recording operation and for the data access.

The recording operation, the memory access operation and the circuit configuration therefor are same as those in the foregoing embodiment and will not, therefore, be explained further.

Fig. 9 shows the circuit configuration of the head substrate of the present embodiment. The recording operation, the memory access operation and the circuit configuration therefor are same as those in the foregoing embodiment and will not, therefore, be

explained further.

The fuse logic circuit 442 is also connected to the pair of memory power supply terminals 447, 448 constituting external connection terminals, whereby the driving electric power required for the fuse logic circuit 442 in executing the data writing into the fuse ROM 441 is supplied from such memory power supply terminals 447, 448.

In the present embodiment, however, an electric power fuse 449 constituting writing inhibition means is inserted in the electric power wiring connecting the memory power supply terminals 447, 448 and the fuse logic circuit 442, and the connection between the memory power supply terminals 447, 448 and the fuse logic circuit 442 is cut off by the fused electric power fuse 449 at the shipment of the printing head 400, whereby the data writing by the fuse logic circuit 442, into the fuse ROM 441 is permanently disabled.

In case the external connection terminals for the printing head 400 are used in common for the recording operation and for the memory access, the noise generated at the execution of the recording operation of the ink jet printer may intrude as writing data into the fuse logic circuit 442.

However, in the printing head of the present embodiment, as shown in Fig. 11, various data are written into the fuse ROM 441 by the fuse logic circuit

442 prior to the shipment of the printing head but the electric power fuse 449 is cut off at the shipment thereof.

Therefore, in the printing head 400 shipped as the product, the driving electric power required for data writing cannot be supplied from the memory power supply terminals 447, 448 to the fuse logic circuit 442, so that the data writing by the fuse logic circuit 442 into the fuse ROM 441 is not realized even if a noise is generated in the course of the recording operation.

In Fig. 11, there are shown processes for writing/reading out data representative of a resistance value of the head heater. In the summary of operations, the left represents a preparatory process for conducting each operation and the right represents an operation actually executed at the head side.

As afore-mentioned, in the ink jet printer 300 of the present embodiment, the data stored in the fuse ROM 441 of the printing head 400 cannot be overwritten by the noise, so that the necessary data stored in the fuse ROM 441 cannot be lost and can always be exactly read from the fuse ROM 441.

The substrate described in the present embodiment can naturally be applied to the configuration of the printing head or of the printer apparatus as explained in the foregoing embodiment.

Also, variations relating to the recording

operation and the memory access, explained in the foregoing embodiment, are also applicable to the present embodiment.

In the foregoing, it has been explained to write all the necessary data into the fuse ROM 441 and then to disable overwriting of all the data by fusing the electric power fuse 449. It is however also possible, as shown in Fig. 12, to write data of plural kinds in succession into the fuse ROM 441 and to individually disable overwriting of the written data of plural kinds in the order of writing. That is, when producing the head substrate, the writing of the ROM is disenabled after writing the resistance value in the ROM. Then, after producing the head, the writing of the ROM is disenabled after writing the head ID in the ROM. Such configuration can be realized by providing plural fuse ROM's 441 and plural electric power fuses 449.

For example, as shown in Fig. 12, the function characteristics of the heater unit 412 are written and the overwriting is disabled in the fuse ROM 441 at the completion of the head substrate 410, and the head ID is written and the overwriting is disabled at the completion of the printing head 400. In this manner it is possible to write various data at appropriate timings in non-rewritable manner, and the data of the function characteristics cannot be overwritten even if a noise is generated at the writing of the head ID.

Also in the foregoing, it has been explained to cut off the power supply wiring between the fuse logic circuit 442 and the memory power supply terminals 447, 448 by the electric power fuse 449, in order to disable data overwriting of the fuse ROM 441 after the data writing. However, it is also possible to cut off the signal wiring for the access permission signal for data writing, in case the signal wiring for entering the access permission signal to the fuse logic circuit is provided separately for the data writing and for the data readout.

The present embodiment, constructed as explained in the foregoing, further provides the following advantages.

As the data writing into the data memory means by the memory access means is permanently disabled by the writing inhibition means, the data stored in the data memory means cannot be overwritten by a noise, eventually intruding into the memory access means from the external connection terminals in the course of the recording operation, and necessary data cannot be lost and can always be read exactly.

In the above-described head substrate, the writing inhibition means cuts off the electric power wiring for supplying the driving electric power for data writing from the external connection terminals to the memory access means, whereby the data overwriting by the

memory access means can be securely prevented as such driving electric power for data writing is not supplied to the memory access means.

In the above-described head substrate, a specified one of the external connection terminals externally receives the access permission signal for permitting the data writing, while the memory access means executes data writing into the data memory means upon externally receiving the access permission signal from the external connection terminal, and the writing inhibition means cuts off the signal wiring for supplying the access permission signal for data writing from the external connection terminal to the memory access means, whereby the data overwriting by the memory access means can be securely prevented since the access permission signal required for data writing is not supplied to the memory access means.

In the above-described head substrate, the memory access means writes data of plural kinds in succession into the data memory means, and the writing inhibition means individually disables the overwriting of the data of plural kinds writing in succession into the data memory means by the memory access means, whereby the data of plural kinds can be written and overwriting can be disabled, at appropriate timings.

In the producing method for the head substrate and the printing head of the present invention, the common

terminal wiring means connects the memory access means and the recording execution means to a common external connection terminal, but the data writing into the data memory means by the memory access means is permanently disabled after the completion of data writing into the data memory means by the memory access means, whereby it is rendered possible to produce a head substrate and a printing head in which the necessary data cannot be lost and can always be read exactly, since the data stored in the data memory means are not overwritten by the noise, eventually intruding into the memory access means from the external connection terminal, in case the recording operation is executed by mounting the printing head in the printer apparatus.

In the producing method for the above-described head substrate and printing head, the electric power wiring for supplying the driving electric power for data writing from the external connection terminals to the memory access means in order to permanently disable the data writing into the data memory means by the memory access means, whereby it is rendered possible to provide a head substrate and a printing head in which the data overwriting by the memory access means is securely prevented since the driving electric power required for data writing is not supplied to the memory access means.

In the producing method for the above-described

head substrate and printing head, the signal wiring connecting the external connection terminal, externally receiving the access permission signal for permitting the data writing, and the memory access means is cut off in order to permanently disable the data writing into the data memory means by the memory access means, whereby it is rendered possible to provide a head substrate and a printing head in which the data overwriting by the memory access means is securely prevented since the driving electric power required for data writing is not supplied to the memory access means.